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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/634,964	08/05/2003	Zhendong Liu	02039US	6941

7590

03/21/2006

Rodel Holdings, Inc.  
Suite 1300  
1105 North Market Street  
Wilmington, DE 19899

EXAMINER

GEORGE, PATRICIA ANN

ART UNIT

PAPER NUMBER

1765

DATE MAILED: 03/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/634,964

Applicant(s)

LIU, ZHENDONG

Examiner

Patricia A. George

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1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 February 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-7 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
  - ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/10/2006 has been entered.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1 - 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sun et al (US Patent No. 6,709,316) in view of Yano (US Patent No. 6,375,545).

The reference of Sun et al discloses an aqueous chemical mechanical planarizing composition (col. 9, l. 14). The composition comprises an oxidizer in the form of promoting barrier removal since the composition is the same (col. 6, lines 57-59); an abrasive in the form of (col. 7, lines 9-12); an inhibitor in the form of (for

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decreasing removal of a metal interconnect) (col. 6, lines 59-65). In addition, Sun et al. clearly discloses ph adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4. Sun et al. also clearly explain the adjusting agents can be comprised of bases, inorganics acids, and/or organic acids (col.6, l.66 to col.7, l.3). Sun teaches a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines32-34). Sun cites a 1:0:0 removal rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric.

In addition Sun teaches a pad pressure of 13.8 kPa. (col. 12, line 1) which is within Sun's range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun broadly discloses the use of a chelating agent (col.6, lines 49-54), including the use of carboxyl acids (see claim 10).

Sun fails to disclose the use of water soluble polymers, made from carboxyl acids, as a feature of the chelating agent.

Yano teaches that such chelating agents are useful (US Patent No. 6,375,545 col. 9, lines 8-16) in CMP slurry (Col. 16, L. 8). (Also see column 6, line 23 –29.)

It would have been obvious to one ordinary skill in the art at the time of invention was made, to include a chelating agent with polymers in the CMP slurry of Sun because Yano teaches polymer blends in slurry are useful in they can be prepared to have ranges of conductivity to enhance the chelating effect of forming bonds with metals. As a result, particulates of the interconnect metals are carried away from the surface of the wafer maximizing removal rates while decreasing surface scratching.

As to claims 2 and 3, Sun broadly discloses the use of a chelating agent (col.6, lines 49-54), including the use of carboxyl acids (see claim 10).

Sun fails to disclose the use of polymers, made from carboxyl acids, as a feature of the chelating agent.

Yano teaches wherein the carboxylic acid polymer comprises a homopolymer or a copolymer (col. 3, lines 8-29) and wherein the carboxylic acid polymer comprises polymaleic acid (col. 7, lines 61-61, and col. 8, line 1). See complete discussion of Sun in view of Yano above.

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify Sun's CMP slurry by adding said chelating agents as Yano teaches they are useful (col. 3, lines 8-29) in CMP slurry.

As to claim 4, see Sun's teaching on pH above.

As to claim 5, Sun teaches an aqueous chemical mechanical planarizing composition comprising 0.05 to 15 wt % abrasive (col. 7, lines 9-12); 0.1 to 10 wt % oxidizing agent (col. 6, lines 57-59); and 0.02 to 1 wt% benzotriazole (col. 6, lines 59-65) which falls within the range of the instant invention. In addition, Sun et al. clearly discloses ph adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4. Sun et al. also clearly explain the adjusting agents can be comprised of bases, inorganics acids, and/or organic acids (col.6, l.66 to col.7, l.3). Furthermore, Sun et al. teaches use of phosphoric and nitric

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acids as a pH adjusting agents (col.7, l. 3-4 and l.59). Sun et al. teaches a tantalum nitride removal rate of at least eighty percent of copper removal rate (col.3, lines32-34). Sun cites a 1:0:0 removal rate which indicates that 100% of the barrier layer (i.e. TaN) is removed relative to 0% of the copper and 0% of the dielectric at a pad pressure of 13.8 kPa. (col. 12, line 1) with in Sun's range of 1 to 8 psi (6.895 kPa to 55.158 kPa). Sun's range is within the claimed range.

The reference of Sun fails to teach the wt % of a carboxylic acid polymer.

Yano teaches 0.01 to 5 wt % of a carboxylic acid polymer (col. 9, lines 20-22), wherein at least one repeat unit of the polymer has at least two carboxylic acid functionalities (col. 3, lines 8-29).

It would have been obvious to one ordinary skill in the art at the time of invention was made, to modify to modify the CMP slurry of Sun to include a chelating agent with polymers because polymer blends in slurry are useful in they can be prepared to have ranges of conductivity to enhance the chelating effect of forming bonds with metals. As a result, particulates of the interconnect metals are carried away from the surface of the wafer maximizing removal rates while decreasing surface scratching.

As to claims 6 and 7, see the references of claims 2 and 3.

### ***Response to Declaration***

Examiner has read the declaration and appreciates the comments made, however the individual declarations were not persuasive in overcoming the prior

rejections. Mr. Liu shares impressive educational background and work experience in declarations 1-3. The examiner appreciates his review of the actions filed August 5, and November 18, of 2005, as stated in declaration 4. The assertions in declaration 5 are acknowledged and examiner agree that ideally a first-step copper slurry may have a zero barrier removal rate, however in the case of the references cited, not only are barrier materials removed but a removal rate for barrier materials is taught. Declaration 6 notes, it is not traditional to use a first method step CMP slurry for removing barrier material, agreeably so, this argument is not commensurate with the claimed composition. Declarations 7, 8, 9, and 10 all point toward the pH of the composition. Even though the prior art teaches examples of pH in ranges outside of the claimed range, the examiner only needs to show one embodiment that teaches the limitation and has properly done so with the references provided.

### ***Response to Remarks***

Applicants' submission that the combined references fail to disclose or suggest claims 1 to 7, is not persuasive.

Applicants' remark, on page 4, that the reference of Sun et al. does not disclose a second step barrier removal slurry is not persuasive in overcoming the rejection. Applicants' state, on page 4, that Sun et al. fails to disclose a pH less than 4 adjusted with an inorganic acid. Examiner disagrees as Sun et al. clearly discloses pH adjusting agent/s can adjust the CMP composition to a range of about 2.5 to about 11, which encompassed the claimed less than 4.

Sun et al.'s first slurry is considered to read on applicants claimed slurry because it contains corresponding components and is functional (i.e removes a portion of the barrier with a know selectivity, illustrating a barrier removal slurry) in applicants claimed range of pH, of less than 4. For instance, see col.7, line 1. The intended use of the first disclosed slurry does not distinguish in this case because it contains corresponding components and functions in the same pH range as claimed by applicants.

On page 5, applicants' write "since Sun et al. disclose a slurry designed for bulk copper removal, teach away from using pH less than 4". Examiner agrees that Sun et al. teaches a variety of CMP slurry compositions, including those of pH ranges outside of the claimed range, however applied first slurry of Sun et al. is taught in a pH range of 2.5 to 11, which encompasses the claimed range of less than 4.

On page 5, applicants say Yano et al. do not disclose the claimed water soluble polymer, yet Yano et al clear teaches carboxylic acid polymer particles having a hydrophilic group (see example 3, and col.7-8, lines 60-3).

### ***Conclusion***

The remarks and declaration filed on 02/10/2006 under a request for continued examination under 37 CFR 1.114, have been considered but are ineffective to overcome the combined reference of Sun et al. of U. S. Patent No. 6,709,316, in view of Yano et al. of U.S. Patent No. 6,375,545.



Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia A. George whose telephone number is (571) 272-5955. The examiner can normally be reached on weekdays from 7:00am to 4:30pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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NADINE G. NORTON  
SUPERVISORY PATENT EXAMINER

